

Overview of Mining Methods

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Four Major Methods

- Plus two niche methods
- Surface
 - MTR
 - Contour/Point Removal
- Surface-Related
 - Auger
 - Highwall
- Underground
 - Room & Pillar
 - Longwall
- Method chosen depends on economic and physical factors

What Method to Use?

■ Depth

- <100' = not UG

■ Ratio

- >15-20 yds/tn coal = not SURF.

■ Capital available

- small = not MTR, not longwall

■ Reserve size

- small = not MTR, not longwall

■ May be a combination of factors

- usually, an obvious choice

MTR

- Recovers 100% of reserves, usually from multiple seams
 - Deep mines may only get 50% or so of one seam
- Use in large reserves with ratios up to 20:1 (yds per tn)
- Large capex, large equipment
- Backstack as much rock as possible (to AOC)
 - put remainder in valley fills -- planner must balance fill volume
- 1/4 - 1/3 of output in Appalach

AOC / Valley Fills

- Fill problem arises from “swell” of material after blasting
- Must store somewhere or there is no room for equipment
- “Durable rock” is put in valley fills
 - Allows valley fills to be end dumped, not spread
 - Large rock will roll further, forms natural drain

Economic Ratios

$$\text{MTR/MTM} = 13 - 20(?) : 1$$

- Can vary, is a function of:
 - Price of coal - Met or Steam
 - Overburden type - SS/SH
 - Topography - average distance rock must be hauled
 - Mostly, equipment type/size
 - Large/small loader/trucks:
 - 13 yd loader + 75t trucks, up to 40 yd loader + 240/310t trucks
 - Lowest cost per yard is dragline
 - But need large capex, therefore large reserve to use larger equipment

Contour Mining

- Haulback & stack overburden
- Smaller equipment, will have smaller reserves
- Can control cost via ratio
 - Stop at the point that highwall becomes uneconomic to mine (10-12:1?)
 - Often combine with augering, highwall mining or point removal to get extra coal
- Excess rock still taken to valley fill

Sequence of Surface Operations

- Remove soil & stockpile
- Prepare drill bench
- Drill
- Blast
- Load & haul overburden
 - Dozer
 - FEL/Truck or Shovel/Truck
 - Dragline
- Load out coal
- Place rock & reclaim surface

Surface-Related Methods

- Used when too deep for surface, too thin or too small for deep
- Auger - drill 200-400 ft holes into highwall
 - Round holes, 33% max recovery
- Highwall miner - remotely mine for 400-1000 ft
 - Auger or conveyor-car haulage
 - Square holes, 45% max recovery
- Specialized method & limited reserves dictate that contractors are normally used

Underground Mining - Longwall

- Large capital, high output
- Thus, requires large reserve
 - +50 million tons, prefer twice that as minimum
- Requires regular shape of property
- Thick seam method
 - 6.0ft+ to be productive
- Not flexible

Longwall

- If conditions are favorable, there is no lower cost method
 - Rates of 1 million rom tpm with 250 people are possible
- Other items:
 - Problem if coal quality is variable
 - Still must develop with continuous miner
 - Get subsidence immediately (& no more) - $\frac{2}{3}$ of seam thickness
 - Changes groundwater flow

Continuous Miners Room & Pillar

- Used if longwall can't be used -
- in smaller or thinner reserves
(or to develop for longwalls)
- Flexible layout
- Used for both development and
pillaring
- Easily moved from place to
place or mine to mine (small
reserves)
- Moderately low capital
- Historically has been the
standard method in Appalachia

Continuous Miners

- Used in seams from 28” to 13 ft
 - Equipment comes in many size ranges
- Room and pillar plan recovers 40-60% of reserve
- Can be low cost, but not in thin seams
- Difficult to justify new “greenfield” continuous miner operation -- normally can’t support cost of new processing plant and mine, too

Longwall Vs. Continuous Miners

- 100% of longwall coal is recovered, maybe 70-80% overall (?) vs 40-60%
- Lower operating cost/ much higher capital
- “Digital” in nature vs “analog”
 - Quantity and quality
- Development may be a problem
 - Many mines find it difficult to keep lw panels developed
- Both produce about 45% of underground output in U.S.

Surface Vs. Underground

- MTR recovers 100% of all seams vs. 40-75% of one or two
- All disturbance is immediate, reclamation is ongoing & close
- Eliminate roof fall danger (but substitute highwall falls)
- Mostly mine coal that is not accessible by underground methods
- Can often control cost by limiting ratio in surface mines

Summary

- Surface mines account for 60-65% of national output, but 30-33% in WV, 38% in KY, 25% in VA and 28% in PA
- Productivity in surface mines is 9.44 tpmh vs 3.84 tpmh in underground, nationally
 - But is 5.75 tpmh vs 4.81 tpmh in WV (approx.)

Longwall Mining



